Journal of Life Sciences & Biomedicine, vol. 3(76), No 1, p. 05-16 (2021)

Effect of climate change on health in Azerbaijan

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Received: April 09, 2021; Received in revised form: April 09, 2021; Accepted: April 05, 2021

It is known that humanity is facing a new and unusual problem, such as global climate change of anthropogenic origin. The causes of this problem, its consequences for the environment, economy, human health, and other areas of life are already being noted. In recent decades, 90 percent of the causes of climate change have been associated with man-made pollution, especially the release of large amounts of "greenhouse gases" (carbon dioxide, methane, water vapor, nitrogen oxides, etc.) into the atmosphere and deforestation. The concentration of "greenhouse gases" in the atmosphere has never been higher in the history of mankind. In particular, the amount of carbon dioxide emitted into the atmosphere as a result of the use of hydrocarbon fuels is increasing rapidly in line with fuel consumption. The essence of the "greenhouse effect" known to science since the first half of the XIX century is that the thermal energy released from the Earth's surface heated by solar energy (50% of solar energy is absorbed by the Earth) is absorbed by atmospheric air and "greenhouse gases". It plays the role of a kind of "polyethylene cover". As a result, the temperature of the Earth's surface and oceans is gradually rising, and the Arctic, Greenland and some large mountain glaciers are degrading. It was found that from 1899 to 2007, the temperature of the Earth's atmosphere increased by more than 1°C, and the temperature of ocean waters increased by 0.8°C. Such global climate change is accompanied by a number of serious cataclysms on the planet - rising sea and ocean levels, river floods, floods, storms, hurricanes, torrential rains, severe heat, drought, forest fires, desertification, and in some places swamps accompanied by natural disasters. Observations show that an increase in ocean temperature by 1.0-1.5°C leads to a rapid decline in several oceanic species, including some fish species. It is predicted that by the end of the XXI century, the level of ocean water will rise by 30-45 cm. This means, first of all, the flooding of large areas, a number of islands and island countries, the world's largest coastal cities, the degradation of agriculture, the threat of food shortages. The economic consequences of natural disasters as a result of global warming include the destruction of houses due to flooding of coastal areas, the lack of drinking water, the deterioration of living conditions of the population accompanied by the failure of engineering facilities and infrastructure. Such natural phenomena are already registered in our country (in recent years, due to the rise in the level of the Kura River, groundwater in the regions, damage to the infrastructure of some mountain rivers, landslides, etc.). The intensification of global climate change increases the expected risk of such events. Therefore, there must be a limit to the impact of human activities on the environment. Global warming of 2°C should be considered an undesirable limit. If at 2°C by the middle of the century, 500 million people will suffer from a shortage of drinking water, at 3°C their number will reach 3 billion. The initiative of Inter-Academy Partnership (IAP) to address the climate change impact on health is a worthy scientific effort. The effects of global climate change, and in particular, its impact on health, are already being felt in many different ways and forms around the world. Research by the World Health Organization (WHO) in 53 countries in the European region shows that the direct health effects of climate change include abnormally high or low temperatures, as well as diseases caused by high temperatures during floods, storms, and forest fires. It is accompanied by an increase in the number of malignant tumors, mental disorders, trauma, and death. According to the WHO, climate change now

causes more than 150,000 premature deaths (excluding predicted deaths) each year. Climate warming, as well as an increase in the number of infectious and parasitic pathogens (acute intestinal infections, viral hepatitis, hemorrhagic fever, etc.), the expansion of the range of some natural foci of infection (tick-borne encephalitis, skin leishmaniasis, malaria, etc.), goes along. Moreover, COVID-19 is also spreading due to a compromised immune system. Thus, the world needs the decarbonization of the world economy and change of financial power from grey to green to initiate the resilience of people and communities to provide a safe and healthy environment for the future generations.

Keywords: *Adaptation, agriculture, climate change, COVID-19, decarbonization, diseases, food security, global warming, health, mitigation*

1. INTRODUCTION

1.1. Climate change and health – A global agenda

One of the WHO's initiatives is the Health and Climate Change Country Profile Project, which is monitoring national and global progress on climate change and health. The Project aims are:

- Increasing responsiveness of the health impacts of climate change;
- Supporting evidence-based decision making to support the flexibility of health systems;
- Supporting health participation in national and international climate processes such as the United Nations Framework Convention on Climate Change (UNFCCC)
- Promoting actions that improve health while reducing greenhouse gas emissions.

WHO's report entitled, "The WHO Health and Climate Change Survey: Tackling Global Progress" emphasizes the neglected link between climate change and health (WHO, 2018). This report emphasized that the rising global temperature was extremely disturbing the social and environmental determinants of health. The global burden of disease increases due to climate change.

A global network of science academies representing more than 130 academies (Inter-Academy Partnership - IAP) and Association of Academies and Societies of Sciences in Asia (AASSA) took the initiative of addressing the challenge of climate change impact on health and will make a wide-ranging global associated report by the end of 2021.

2. CLIMATE CHANGE AND HEALTH IMPACT IN AZERBAIJAN

2.1. Climatic features of Azerbaij*an*

Azerbaijan's geography covers a various collection of landscapes, from wetlands to high mountains, deserts to fertile valleys. The center of the country is taken up by a broad valley, centered around the Kura River. This valley is bordered to the north by the Greater Caucasus Mountains, and to the south by the Lesser Caucasus Mountains, and opens in the east to the Caspian Sea. The highest point in Azerbaijan is Bazarduzu Dagi, at 4,467 m (14,656 ft), and the lowest point is - 28 m (-92 ft), in the Caspian Sea.

The Caspian Sea is home to many species of fish, and the shores hold important wetlands, where numerous species of birds live. Even though the Caspian Sea is called a sea, it's actually the largest lake in the world.

The issue of well-organized use of climate resources in agricultural production is one of the central tasks to solve the food problem. To implement it, it is necessary to study the features of our area in depth, to identify potential opportunities for more efficient and rapid development of agriculture. As we know, the existing 9 out of the world's 11 climate zones in Azerbaijan enable growing abundant agricultural products in different regions of it in all seasons. This assists to provide the population with agricultural products around the year. Today 3 large enterprises in Republic realize the processing of agricultural products that meet ecological standards (Humbatova et al., 2020). Besides these enterprises, several family farms deal with the processing of homemade ecological products. They are mainly engaged in

the desiccation of fruits (plums, apricots, figs, apples, cornel, hirnic, and other wild plants), confuter and jams, soaps, juices, and compotes.

In general, Azerbaijan is a mountainous country. Therefore, the study of the spatial and temporal distribution of natural factors, quantitative relationships of individual elements of the climate, the distribution of agroclimatic indicators depending on altitude, indented relief, exposure of slopes is of great scientific and practical importance. Due to its location in the southern hemisphere, the territory of Azerbaijan receives a lot of sunlight and heat. The duration of sunlight in the Kura-Araks lowland is 2200-2400 hours per year, and the annual amount of PAR (photosynthetic active radiation) is more than 64 kcal/cm^2. The maximum value of these indicators is observed in the Arzaboyu plain (more than 2800 hours and more than 76 kcal/cm^2, respectively). The annual flow of solar energy in the area is also well expressed. At a time when solar energy is most concentrated (April-October), the total PAR is 50-54 kcal/cm^2 in the Kura-Araks lowland and 59-60 kcal/cm^2 in the plains of the Nakhchivan Autonomous Republic (eco.gov.az/az/hidrometeoro-logiya).

In summer, the lighting conditions on the eastern slopes are better than on the western slopes. Plants are more affected by frost on the eastern slopes. As the heating effect of solar radiation increases, plants in the mountains require a lower total temperature than in the plains in the interfacial period. It is of practical importance to take this effect into account when relocating crops to mountainous areas.

Much of the area is characterized by high thermal regimes, low rainfall, and in some places very low rainfall. Almost the entire Kura-Araks lowland, the Absheron Peninsula, and the Arazboyu plain receive only 110-350 mm of rainfall per year. Thus, the amount of precipitation in the mountainous area increases with altitude. Accordingly, the role of precipitation in humidity is increasing due to the decrease in air temperature. At first glance, it seems that the total amount of precipitation in many areas is enough to meet the plant's need for moisture. However, the annual rainfall regime is such that at a time when the plant is growing intensively and transpiration is increasing, it is not sufficiently supplied with moisture.

2.2. Previous Academy Publications on Climate Change and Health

Unfortunately, ANAS did not publish any report on Climate Change and Health but there are a number of papers on this issue, published by academy institutions. Publications on the subject of climate change and health by the Azerbaijani scientists have been listed.

Agayev I., Vahabov E., Jalilov V. et al. (2020) Epidemiological situation and spatial distribution of visceral leishmaniasis in the Republic of Azerbaijan. *J. Parasit. Dis.,* **44:** 639–645 (2020).

Aliyev K., Gasimov I. (2020) Life (DIS) satisfaction and intention to emigrate in Azerbaijan: Mediating role of institutional trust. *Economic and Social Development: Book of Proceedings*, **3:** 306-313.

Allakhverdiev A.R., Allakhverdieva A.A., Babayev E.S. (2020) Functional state of the brain of elderly women at rest and in mental stress under varying geomagnetic conditions. *Hum. Physiol.,* **46:** 408–416.

Guliyeva A.E., Lis M. (2020) Sustainability Management of Organic Food Organizations: A Case Study of Azerbaijan. *Sustainability*, **12(12):** 5057.

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Neudert R., Allahverdiyeva N., Mammadov N., Didebulidze A., Beckmann V. (2020) Diversification of livestock-keeping smallholders in mountainous rural regions of Azerbaijan and Georgia. *Land*, **9(8):** 267.

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2.3. Effect of climate change in Azerbaijan

One of the global problems that the world faces is climate change. The world community is increasingly concerned about climate change and its impact on the living world. Azerbaijan ranked 111, according to the 2019 Global Climate Risk Index report which was released by the Germanatch, a public policy group (Eckstein et al., 2019). The major contribution to this climate change is the greenhouse gas emissions (CO_2, CH_4, N_2O, and H_2O), though Azerbaijan's contribution to global greenhouse gas emissions is negligible and insignificant.

Unstable weather conditions are felt not only in Azerbaijan but also in a number of countries around the world and create problems. Increased attention to these problems is reflected in the holding of a number of international events, including scientific and practical conferences. According to a recent assessment by the Intergovernmental Panel on Climate Change, the average global temperature has risen by 0.8 degrees over the past 100 years. The increase in temperature is mainly due to anthropogenic factors. Anthropogenic factors are based on gases that create a thermal effect: carbon, methane, nitrogen oxide, nitrogen oxide 1, and chlorine-fluorine compounds. The last 100 years of space observations show that both the intensity and frequency of storms and blizzards have increased. Warm winds, hurricanes, and rains intensified. At the same time, the number of floods has increased. If the surface of the ocean is used to heat up to a depth of 1,000 meters, now the heat reaches a depth of 2,000 meters. This causes the hot streams to heat up even more. That is, climate change is a key factor in the growth of all these natural disasters.

Azerbaijan has also been affected by global climate change. Over the past 100 years, the average annual temperature in Azerbaijan has increased by 0.4-1.3ºC. The temperature-rise is unevenly distributed depending on the regions. In the last 10 years, the number and intensity of floods in small mountain rivers in the territory of Azerbaijan have increased.

Heatwaves and natural fires are other consequences of climate change. Valleys, where normal temperatures used to be around 35~40ºC, are now having a temperature of 45ºC on several days during the season. Desertification is one more thoughtful effect of climate change in Azerbaijan.

2.4. Impact of climate change on human health

Climate change is the supreme hazard to worldwide health in the 21st century. The possessions of global warming consist of their effects on human health. The experimental and expected increased climate change-related impacts will auxiliary intensify the effects on human health. Climate change is affecting the safety of shelter, air and water quality, food availability, and nutrition levels in the food that impacts human health. As climate change grows, scientists assume an increase in related health issues. Cold and heatwaves, droughts, storms, floods, land sliding, and natural fires can cause injury, illness and death directly. Besides, due to the environmental and ecological conditions, the quality and yield of crops, and availability of food items there could be decreased. Also, the availability of clean drinking water can be decreased which will lead to the spread of water-borne and vector-borne diseases. Altogether, climate change could result in poverty, hunger, food insecurity, and ill-health.

2.4.1. Impact of climate change on agriculture and food security

The impact of climate change on the world is already clear, and signs of this are being observed in Azerbaijan. Compared to other sectors of the economy, agriculture is the most dependent on climatic conditions. Agricultural production is sensitive to weather conditions and is therefore directly affected by climate change. Currently, non-seasonal weather conditions are observed in Azerbaijan. The most severe period of the winter season in February of this year was above normal in the Republic, and on some days in the lowlands was 15-20%.

In 2018, the average annual precipitation was 480 mm, and in 2019 - 360 mm. In 2020, the downward trend and uneven distribution of precipitation continued. The current situation requires a reconsideration of production models in agriculture, the application of modern cultivation

technologies, and irrigation methods. The main crop in the country is cereals. In areas where there is normally enough rainfall in the autumn, there is a serious lack of rainfall during the planting season. Due to the lack of moisture in the soil, most of the seeds sown did not germinate, and the germinated seeds did not develop due to drought. They cause serious damage when feeding on them. During severe climate change, productivity decreases, crop losses increase, and product quality declines. More than 80 percent of crop production in the country is produced on irrigated lands. In this regard, the reduction of water resources due to climate change has put serious pressure on agriculture.

Impacts of climate change on crop production in Azerbaijan are:

• *Lacking of irrigation water, on the contrary, increasing demand for water from crop products;*

• *Decreasing rainfall in remote areas, resulting in lower productivity;*

• *Changing in the vegetation period of plants with changes in the seasonal cycle and changes in the timing of the product on the market;*

• *Increased spring drought;*

• *Creating favorable conditions for the development of plant pests.*

• *Decreasing in the number of irrigations due to water scarcity in the irrigation system and resulting in lower productivity (especially in cotton and grain)*

Impacts of climate change on livestock in Azerbaijan are:

• *Decreasing productivity in natural pastures and increased risk of erosion*

• *Increasing infectious diseases and, accordingly, preventive measures,*

• *Expanding of desertification, reduction of natural pastures and hayfields,*

• *Decreasing biodiversity and vegetation in natural pastures.*

The "Strategic Roadmap for the Production and Processing of Agricultural Products in Azerbaijan" envisages preventive measures to reduce the impact of climate change on agriculture.

2.4.2. Risk of infectious and vector-borne diseases

Climate changes have an actual deep effect on the life-cycle and growth of infectious organisms. Hence, the transmission of water and food-borne diseases is at a peak after the rainy and flooding season. Malaria vectors in Azerbaijan include *Anopheles maculipennis* (the Caucasus), *An. sacharovi* (Kura-Araksin and Lenkoran lowlands) and *An. Persiensis* (Lenkoran lowland) in 2011 (WHO Azerbaijan, 2011). Malaria was once common in Europe and happened almost as far north as the Arctic Circle. Recurrent outbreaks have occurred in Eastern Europe, Azerbaijan, Tajikistan, and Turkey. However, none of these outbreaks was associated with climate change but rather with hydro-agricultural development schemes, movement of infected cases, and the cessation of malaria-control activities (Githeko et al., 2000; Temel, 2004). Azerbaijan successfully interrupted malaria transmission in 2013, meeting its national goal laid out in the 2008–2013 strategic plan. Now the country focuses on preventing malaria re-introduction. In 2015, the national strategy for the prevention of malaria reintroduction for the years 2015–2020 was adopted (WHO Reports Azerbaijan, 2020a). According to the WHO's report, Azerbaijan effectively broke up malaria transmission in 2013, meeting its national goal laid out in the 2008–2013 strategic plan. Now Azerbaijan focusses on avoiding malaria reintroduction. The national strategy for avoidance of malaria reintroduction for the years 2015–2020 was adopted in 2015.

Leishmaniasis is a neglected and poorly reported disease with an underestimated burden in most countries of the Region. The regional incidence of VL and cutaneous leishmaniasis (CL) could be estimated at less than 2% of the global burden. Cases of anthroponotic CL, which is caused by *L. tropica*, could be found in Azerbaijan (Agayev et al., 2020). Cholera, diarrhea, hepatitis A, typhoid are also typical water-borne diseases in Azerbaijan. However, we do not have exact data for these diseases.

2.4.3. Impact of high levels of pollens, allergens and "smog"

Increased temperatures contribute to higher levels of pollens and allergens in the atmosphere, which cause airway inflammation, asthma symptoms, and increased healthcare utilization among individuals. Transport, industrial emissions and crop burning residues have become major causes of pollution, especially in the capital city Baku (Krzyżanowski et al., 2005; Lacey et al., 2017).

2.4.4. Impact of heatwaves and natural fires

Although now heat waves are more common in the cities of the country due to climate change, most natural fires happen in the mountain areas because of the extremely hot weather conditions. This leads to the loss of wildlife and vegetation.

2.4.5. Impact on the development of chronic diseases

According to the WHO's report, during the last ten years, circulatory system diseases have increased by 5%, respiratory system diseases 11%, endocrine disorders 2.5 times (including diabetes 3.7 times), nervous system diseases by 15%, malignant neoplasms by 30%. During this period, the global prevalence of noncommunicable diseases has risen by 14%. As in most countries, noncommunicable diseases are the leading cause of morbidity and mortality in Azerbaijan. Noncommunicable diseases accounted for 50% of all diseases, including 17.6% circulatory system diseases, 15% respiratory system diseases, 15% endocrine disorders, 2.7% malignant neoplasms (WHO Reports Azerbaijan, 2020b). During 10 years (2007-2017) cirrhosis, Alzheimer's disease, and lung cancer increase significantly in Azerbaijan, although, ischemic heart disease and stroke are always on the top of the chronic diseases, which cause the most deaths (www.healthdata.org/azerbaijan).

Food insecurity and malnutrition, higher temperature, heatwaves and pollution, and weakened health systems due to climate change are directly related to global diabetes epidemics according to the 2012 report of the International Diabetes Federation (International Diabetes Federation, 2012).

2.4.6. Impact on the risk of development of cancer

Climate change is already increasing the number of toxic chemicals, especially carcinogens after extreme weather events such as hurricanes and wildfires in nature. Increased exposure of humans to these toxic chemicals can lead to various types of cancer such as liver cancer, breast cancer, and lung cancer. Moreover, various air pollutants have also been shown to be causing lung cancer in humans (National Institute of Environmental Health Sciences, 2019). In addition to increasing cancer risk, climate change is also affecting cancer survival (Nogueira et al., 2020). The frequency of stomach cancer and lung cancer is higher in Azerbaijan (www.healthdata.org/azerbaijan). The high incidence of these types of cancer is recognized as a consequence of adverse changes in the environment.

2.4.7. Impact on mental health

One of the health-related fields is the impact of environmental changes on mental health, which has not been adequately investigated in Azerbaijan. However, few works have been done to study the effect of the geomagnetic conditions (Allakhverdiev et al., 2020). Depression, anxiety, psychological distress, post-traumatic stress, aggression, complicated grief, complex psychopathology, sleep disorders, sexual dysfunction, social avoidance, irritability, drugs, etc. are the most common mental health forms, which climate change affects.

2.5. Adaptation and mitigation

Azerbaijan has already identified social and economic development and poverty reduction as its priorities. The country's mitigation and adaptation strategies for climate change are reflected in the following long-term State Programs:

- State Program on the Use of Alternative and Renewable Energy Sources (2004);
- Azerbaijan 2020-FUTURE CONCEPT OF DEVELOPMENT;
- State Program on Socio-Economic Development of the Region in the Republic of Azerbaijan for 2008-2015 (2008-2015);
- State Program on Poverty Reduction and Sustainable Development in the Republic of Azerbaijan for 2008-2015 (2008-2015);
- Strategic Roadmap for Agricultural Production and Processing in the Republic of Azerbaijan, 2016;
- To achieve the Sustainable Development Goals, The National Coordinating Council for Sustainable Development (NCCSD) of Azerbaijan was established (2016).

Preventive measures against the consequences of climate change should also focus primarily on the development of technologies that increase the opportunities for sustainable and efficient use of land and water resources, optimization and adaptation of the agricultural sector. For that, we need to do:

- ✓ Soil monitoring and comparative research to study the consequences of climate change. Development of mathematical forecasting models based on complex and multidisciplinary research;
- ✓ Conducting research in the field of maintaining soil fertility, prevention of salinization, water and wind erosion;
- ✓ Development of an improved system of agro-technical and phytomeliorative measures to prevent soil erosion;
- ✓ Application of irrigation water-saving irrigation systems in the conditions of an arid zone, development of the concept of efficient use of existing water resources;
- ✓ Study of the possibility of adaptation of new varieties of drought- and salt-resistant created in the field of plant breeding in different soil-climatic zones.

For successful development of action, all the stakeholders including the government agencies and academy institutions must join hands to meet the climate change and health challenges in Azerbaijan.

2.5.1. What needs to be done regarding adaptation and mitigation

We need to create coordination among various institutions related to climate change in Azerbaijan, there is an urgent need to address the problem as one of the uppermost importance plan items.

2.6. Recent initiatives by government of Azerbaijan for climate change mitigation and adaptation

2.6.1. International agreements

- ➢ The Republic of Azerbaijan acceded to the UN Framework Convention on Climate Change in 1995 and ratified the Kyoto Protocol in 2000.
- ➢ The Doha Annex, adopted for the second period of implementation of the Kyoto Protocol, was ratified by the Milli Majlis (The National Parliament) of the Republic of Azerbaijan on April 14, 2015, and signed by the President of the country.
- ➢ The Paris Agreement was signed in April 2016 and ratified by the Milli Majlis on October 28, 2016. By the Paris Agreement, the Republic of Azerbaijan submitted its National Contributions to the Secretariat of the Convention and aims to reduce greenhouse gas emissions by 35% by 2030 compared to the base year (1990) as its contribution to global climate change mitigation initiatives.

2.6.2. Climate change mitigation measures

Although Azerbaijan has not made quantitative commitments to reduce emissions from the Kyoto Protocol, the country has taken several important steps in recent years, including the introduction of low-carbon, energy-efficient, renewable energy and waste management technologies, as well as forest expansion and deforestation.

In addition to national mitigation initiatives, Azerbaijan successfully cooperates with several international organizations through the implementation of various projects. Thus, more than 30 projects related to climate change mitigation technology and capacity building have been implemented (eco.gov.az).

2.6.3. Prevention of intrusion of the Caspian Sea

The main factors determining the climate of the Caspian Sea - the geographical location of the sea, the nature of atmospheric circulation, the impact of surrounding land areas - are the Aral-Caspian lowlands in the east, the Caucasus Mountains in the west and water exchange between different parts of the sea. The main characteristic of the Caspian climate is the predominance of anticyclone weather conditions, sharp temperature changes throughout the year, cold, and windy winters in the North Caspian and hot in the South Caspian, and hot, dry, and calm summers throughout the Caspian.

The water of the Caspian Sea is of oceanic origin and the average salinity is 12.85‰ (promille) (average salinity of ocean water is 35‰). Low salinity is since the sea is closed and fed mainly by river currents. The Caspian Sea has more carbonates and sulfates than ocean waters and fewer chlorides. Strong fluctuations in the Caspian Sea occur, especially during strong north and south winds in autumn and winter.

Observations are carried out on water level, water temperature, salinity, color, transparency, wave height, length and period, air temperature, humidity, amount of cloudiness, wind speed and direction, atmospheric pressure, precipitation in

the Caspian observation network to study the hydrometeorological conditions of the Caspian Sea. Studies covering the hydrometeorological regime of the Caspian Sea are carried out at 4 observation times at the stations and points located in the coastal zone and open sea. Thanks to the continuous information received from the observation network, it is possible to analyze the long-term hydrometeorological conditions of the Caspian Sea. The National Hydrometeorology Department exchanges information in cooperation with CASPCOM, the coordination center of the Caspian littoral states.

Climate change affects all hydrometeorological parameters as well as the sea level.

2.7. Covid-19 pandemic and climate change

The first Covid-19 case was identified in Azerbaijan on February 29, 2020. Until September 29, 2020; more than 40,061 positive cases of Covid-19 have been identified and 588 deaths were caused by this infection. Although, the complete lockdown for several months has harshly affected the economy of Azerbaijan it also had a positive influence on greenhouse gas emissions and the environment. The air quality index in major cities in Azerbaijan becomes better. The health system in Azerbaijan has been challenged. Moreover, people suffering from non-Covid diseases were able to get mental problems due to the long complete lockdown for several months. We believe that a climate-smart approach that may also offer a better human immune system is likely to provide better health for future generations against the pandemic.

3. CONCLUSIONS AND RECOMMENDATIONS

In a world of numerous “what if” scenarios of immediate climate change, it becomes difficult to make health policies for the future, because of the improbability of expecting environmental change and human decisions. To be familiar with the difficulty of this issue, an ad hoc Interagency Working Group on Climate Change and Health (IWGCCH) bring together to develop research and science needs, including research on mitigation and adaptation strategies. This research includes basic and applied science, technological innovations and capacities, public health infrastructure, communication and education. Attention is also given to the possible structure of the climate change and health research agenda and the use of these research results for applications and decision making. Azerbaijan being a developing country with an oil-based economy has been most severely affected by climate change and its subsequent events and this is seriously affecting the health of the people. To address the challenge of climate change impact on health, it is authoritative to take measures towards mitigation, and to mitigate we need to identify the priority scientific fields. The challenges that science needs to be addressed is the impact of climate change on human health are: 1) Asthma, Respiratory Allergies, and Airway Diseases; 2) Cancer; 3) Cardiovascular Disease and Stroke; 4) Foodborne Diseases and Nutrition; 5) Human Developmental Effects; 5) Heat-Related Morbidity and Mortality; 6) Neurological Diseases and Disorders; 7) Vectorborne and Zoonotic Diseases; 8) Waterborne Diseases; 9) Weather-Related Morbidity and Mortality; 10) Human immune system; 11) Pandemics. All these aspects become more predominant because of the increased human exposure to climate change. Adaptation and mitigation adaptation may significantly diminish these risks (WHO Reports, 2016). Research should address the relationship between climate change and the factors which affect human health.

A division on “Climate Change and Health” in the Azerbaijan National Academy of Sciences and the government should be created to prepare a scientific, economic, and political agenda for the adaptation and mitigation strategies. The specific areas which could be determined by such divisions should receive-extreme consideration.

ACKNOWLEDGMENTS

We thank the Division of Biological and Medical Sciences of Azerbaijan National Academy of Sciences, its Institutions and the staff members. We also thank the staff members of the Ministry of Health, the Ministry of Ecology and Natural Resources, the Ministry of Agriculture, the Food Safety Agency, and the Management Union of Medical Territorial Units who involved in the preparation of this report.

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İqlim dəyişikliyinin Azərbaycanda sağlamlığa təsiri

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Bəşəriyyətin antropogen mənşəli qlobal iqlim dəyişikliyi kimi yeni və qeyri-adi bir problemlə üzləşdiyi məlumdur. Bu problemin səbəbləri, ətraf mühit, iqtisadiyyat, insan sağlamlığı və həyatın digər sahələri üçün nəticələri artıq hiss olunur. Son onilliklərdə, iqlim dəyişikliyi səbəblərinin yüzdə 90-ı texnogen çirk-

lənmə ilə, xüsusən atmosferə çox miqdarda "istixana qazları" (karbon qazı, metan, su buxarı, azot oksidləri və s.) və meşələrin qırılması ilə əlaqələndirilir. Atmosferdəki "istixana qazları"nın qatılığı bəşəriyyət tarixində heç vaxt bu qədər yüksək olmayıb. Xüsusilə, karbohidrogen yanacaqlarının istifadəsi nəticəsində atmosferə atılan karbon dioksid miqdarı yanacaq istehlakına uyğun olaraq sürətlə artır. XIX əsrin birinci yarısından bəri elmə məlum olan "istixana effekti"nin mahiyyəti ondan ibarətdir ki, günəş enerjisi ilə qızdırılan yer səthindən çıxan istilik enerjisi (günəş enerjisinin 50%-i Yer tərəfindən udulur) atmosfer havası və "istixana qazları" tərəfindən udulur. Bu bir növ "polietilen örtük" rolunu oynayır. Nəticədə, Yer səthinin və okeanların temperaturu tədricən yüksəlir və Arktika, Qrenlandiya və bəzi böyük dağlarda buzlaqlar əriyirlər. 1899-cu ildən 2007-ci ilə qədər Yer atmosferinin istiliyinin 1°C-dən çox, okean sularının temperaturunun isə 0,8°C artdığı göstərilmişdir. Bu cür qlobal iqlim dəyişikliyi planetdə bir sıra ciddi kataklizmlərlə müşayiət olunur - dəniz və okean səviyyəsinin yüksəlməsi, çay daşqınları, daşqınlar, fırtınalar, qasırğalar, leysan yağışlar, şiddətli istilər, quraqlıq, meşə yanğınları, səhralaşma və təbii fəlakətlər nəticəsində bəzi yerlərdə bataqlıqlar əmələ gəlməsi ilə müşayiət olunur. Müşahidələr göstərir ki, okean temperaturunun 1,0-1,5°C-yə yüksəlməsi bəzi balıq növləri də daxil olmaqla bir neçə okean növünün sürətlə azalmasına səbəb olur. XXI əsrin sonlarında okean suyunun səviyyəsinin 30-45 sm artacağı proqnozlaşdırılır. Bu, ilk növbədə, geniş ərazilərin, bir sıra adaların və ada ölkələrinin, dünyanın ən böyük sahil şəhərlərinin su basması, kənd təsərrüfatının deqradasiyası, ərzaq çatışmazlığı təhlükəsi deməkdir. Qlobal istiləşmə nəticəsində baş verən təbii fəlakətlərin iqtisadi nəticələrinə sahil ərazilərini su basması, içməli suyun olmaması, mühəndis qurğularının və infrastrukturun sıradan çıxması ilə müşayiət olunan əhalinin yaşayış şəraitinin pisləşməsi səbəbindən evlərin dağıdılması daxildir. Bu cür təbiət hadisələri artıq ölkəmizdə qeydə alınmışdır (son illərdə Kür çayının səviyyəsinin qalxması, bölgələrdəki yeraltı suları, bəzi dağ çaylarının infrastrukturuna ziyan vurması, sürüşmə və s.). Qlobal iqlim dəyişikliyinin intensivləşməsi bu kimi hadisələrin gözlənilən riskini artırır. Buna görə də insan fəaliyyətinin ətraf mühitə təsirinin bir həddi olmalıdır. Qlobal istiləşmə 2°C arzuolunmaz bir sərhəd sayılmalıdır. Əsrin ortalarında qlobal istiləşmə 2°C oland 500 milyon insan içməli su çətinliyindən əziyyət çəkirsə, 1lobal istiləşmə 3°C olarsa onların sayı 3 milyarda çatacaqdır. İqlim dəyişikliyinin sağlamlığa təsirini həll etmək üçün Akademiyalararası Tərəfdaşlığın (IAP) təşəbbüsü layiqli bir elmi səydir. Qlobal iqlim dəyişikliyinin təsiri və xüsusən də onun sağlamlığa təsiri onsuz da dünyada bir çox fərqli şəkildə və formada hiss olunur. Ümumdünya Səhiyyə Təşkilatının (ÜST) Avropa bölgəsindəki 53 ölkədə apardığı araşdırmalar göstərir ki, iqlim dəyişikliyinin sağlamlığa birbaşa təsirlərinə anormal dərəcədə yüksək və ya aşağı temperatur, həmçinin daşqın, fırtına və meşə yanğınları zamanı yüksək temperaturun yaratdığı xəstəliklər daxildir. Bunlar da bədxassəli şişlər, zehni pozğunluqlar, travma və ölüm sayında artım ilə müşayiət olunur. ÜST-yə görə, iqlim dəyişikliyi hazırda hər il 150.000-dən çox erkən ölümə səbəb olur (proqnozlaşdırılan ölümlər istisna olmaqla). İqlim istiləşməsi, həmçinin yoluxucu və parazitar patogenlərin (kəskin bağırsaq infeksiyaları, viral hepatit, hemorajik qızdırma və s.), bəzi təbii infeksiya ocaqlarının (gənə ensefaliti, dəri leyşmaniozu) genişlənməsi, malyariya və s.), sayının artması birlikdə hərəkət edirlər. Üstəlik, COVID-19, zəifləmiş bir immunitet sistemi səbəbiylə də yayılır. Belə ki, dünya, gələcək nəsillər üçün etibarlı və sağlam bir mühit təmin etmək üçün, insanların və icmaların dayanıqlı inkişafını təmin etmək üçün dünya iqtisadiyyatın dekarbonlaşdırılmasına və maliyyə gücünün bozdan yaşıla keçməsinə ehtiyac duyur.

Açar sözlər: *COVİD-19, əkinçilik, qida təhlükəsizliyi, qlobal istiləşmə, xəstəliklər, iqlim dəyişikliyi, karbohidrogensizləşmə, sağlamlıq, təsirlərin azaldılması, uyğunlaşma*

Влияние изменения климата на состояние здоровья населения Азербайджана

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Известно, что человечество столкнулось с новой и необычной проблемой, такой, как глобальное изменение климата антропогенного происхождения. К настоящему времени уже выявлены причины этой проблемы, ее последствия для окружающей среды, экономики, здоровья человека и других сфер жизни. 90 процентов причин, приводящих к изменению климата в последние десятилетия, были связаны с антропогенным загрязнением, особенно с выбросом в атмосферу большого количества «парниковых газов» (углекислого газа, метана, водяного пара, оксидов азота и т. д.) и вырубкой лесов. В истории человечества концентрация «парниковых газов» в атмосфере никогда не была так высока, как сейчас. В частности, количество выбрасываемого в атмосферу углекислого газа, образующегося в результате использования углеводородного топлива, быстро увеличивается вместе с расходом топлива. Суть «парникового эффекта», известного науке с первой половины XIX века, заключается в том, что тепловая энергия, выделяемая с поверхности Земли, нагретой солнечной энергией (50% солнечной энергии поглощается Землей), поглощается атмосферным воздухом и «парниковыми газами», образуя прослойку, играющую роль своеобразной «полиэтиленовой оболочки». В результате, температура поверхности Земли и океанов постепенно повышается, а ледяные массивы Арктики, Гренландии и некоторых крупных горных ледников деградируют. Выяснилось, что с 1899 по 2007 годы температура атмосферы Земли увеличилась более чем на 1°C, а температура воды в океане - на 0,8°C. Такое глобальное изменение климата сопровождается рядом серьезных катаклизмов на планете: повышением уровня моря и океана, наводнениями, штормами, ураганами, проливными дождями, сильной жарой, засухой, лесными пожарами, опустыниванием, а в некоторых местах образованием болот, формирующихся в результате стихийных бедствий. Наблюдения показывают, что повышение температуры океана на 1,0–1,5°C приводит к быстрому сокращению численности ряда океанических видов, в том числе, некоторых видов рыб. Прогнозируется, что к концу XXI века уровень воды в океане поднимется на 30-45 см. Это означает, прежде всего, затопление больших территорий - ряда островов и островных стран, крупнейших прибрежных городов мира-, деградацию сельского хозяйства, угрозу нехватки продовольствия. К экономическим последствиям стихийных бедствий в результате глобального потепления можно отнести разрушение домов из-за затопления прибрежных территорий, нехватку питьевой воды, ухудшение условий жизни населения, сопровождающееся выходом из строя инженерных сооружений и инфраструктуры. Подобные природные явления уже регистрируются в нашей стране (в последние годы из-за подъема уровня реки Кура и грунтовых вод в регионах, повреждается имеющаяся там инфраструктура, а также инфраструктура, расположенная вдоль некоторых горных рек, возникает опасность схождения оползней и т. д.). Усиление глобального изменения климата увеличивает ожидаемый риск таких событий. Следовательно, должен быть предел воздействия человеческой деятельности на окружающую среду. Глобальное потепление на 2°C следует рассматривать как нежелательный предел. Если к середине века температура воздуха увеличится на 2°C, то от нехватки питьевой воды будут страдать 500 миллионов человек, при 3°C их число достигнет 3 миллиардов. Инициатива Межакадемического партнерства (IAP) по решению проблемы воздействия изменения климата на здоровье человека является достойным научным почином. Последствие глобального изменения климата и, в

частности, его влияние на здоровье человека уже отмечено во всех странах мира и проявляется в различных формах. Исследования Всемирной организации здравоохранения (ВОЗ) в 53 странах европейского региона показывают, что прямым последствием изменения климата, включающего аномально высокие или низкие температуры, наводнения, штормы и лесные пожары, является увеличение количества злокачественных опухолей, психических расстройств, травм и летального исхода. По данным ВОЗ, изменение климата в настоящее время вызывает более 150 000 преждевременных смертей ежегодно (не считая прогнозируемых). При потеплении климата, увеличивается количество возбудителей инфекционных и паразитарных заболеваний (острые кишечные инфекции, вирусные гепатиты, геморрагическая лихорадка и др.), одновременно с этим расширяется ареал некоторых природных очагов инфекции (клещевой энцефалит, кожный лейшманиоз, малярия и т. д). Более того, распространение COVID-19 также связано с ослаблением иммунной системы. Таким образом, миру нужна декарбонизация мировой экономики и изменение финансовой мощи с серой на зеленую, чтобы стимулировать жизнестойкость людей и живых сообществ и обеспечить безопасную и здоровую окружающую среду для будущих поколений.

Ключевые слова: *Адаптация, болезни, глобальное потепление, декарбонизация, здоровье, изменение климата, продовольственная безопасность, сельское хозяйство, смягчение последствий, COVİD-19*